

FORM PTO-1390 (Modified)  
(REV 10-95)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

10438-0001-6 PCT

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/380080

INTERNATIONAL APPLICATION NO.

PCT/SE98/00273

INTERNATIONAL FILING DATE

17 FEBRUARY 1998

PRIORITY DATE CLAIMED

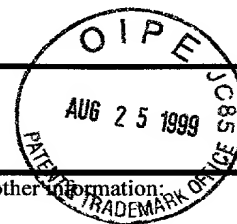
25 FEBRUARY 1997

TITLE OF INVENTION

HEAT EXCHANGER WITH LEAKAGE VENT

APPLICANT(S) FOR DO/EO/US

Lars PERSSON



Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

## Items 13 to 18 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.  
A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☐ Certificate of Mailing by Express Mail
19. ☒ Other items or information:

Request for Consideration of Documents Cited in International Search Report

Notice of Priority

PCT/IB/304

PCT/IB/308

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <div style="font-size: 1.5em; font-weight: bold;">09/380080</div>		INTERNATIONAL APPLICATION NO. PCT/SE98/00273		ATTORNEY'S DOCKET NUMBER 10438-0001-6 PCT	
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20. The following fees are submitted:

BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5)) :			CALCULATIONS PTO USE ONLY	
<input type="checkbox"/> Search Report has been prepared by the EPO or JPO .....	\$840.00			
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) .....	\$670.00			
<input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) .....	\$760.00			
<input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO .....	\$970.00			
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) .....	\$96.00			
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>			<b>\$970.00</b>	
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).			<b>\$130.00</b>	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	- 20 =	0	x \$18.00	<b>\$0.00</b>
Independent claims	- 3 =	0	x \$78.00	<b>\$0.00</b>
Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>
<b>TOTAL OF ABOVE CALCULATIONS =</b>				<b>\$1,100.00</b>
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>
<b>SUBTOTAL =</b>				<b>\$1,100.00</b>
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	<b>\$0.00</b>
<b>TOTAL NATIONAL FEE =</b>				<b>\$1,100.00</b>
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>
<b>TOTAL FEES ENCLOSED =</b>				<b>\$1,100.00</b>
			Amount to be: refunded	\$
			charged	\$

☒ A check in the amount of **\$1,100.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \_\_\_\_\_ to cover the above fees.  
A duplicate copy of this sheet is enclosed.


☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **15-0030** A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

**OBLON, SPIVAK, McCLELLAND, MAIER & NEUSTADT, P.C.**  
 1755 Jefferson Davis Highway, Fourth Floor  
 Crystal Square Five  
 Arlington, Virginia 22202  
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**WILLIAM E. BEAUMONT**  
 REGISTRATION NUMBER 30,996



SIGNATURE

**Gregory J. Maier**

NAME

**25,599**

REGISTRATION NUMBER

**August 25, 1999**

DATE

10438-0001-6 PCT

15 NOV 1999

4

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :  
LARS PERSSON : ATTN: NEW APPLICATION DIVISION  
SERIAL NO: 09/380,080  
FILED: AUGUST 25, 1999 :  
FOR: HEAT EXCHANGER WITH :  
LEAKAGE VENT

PRELIMINARY AMENDMENT

ASSISTANT COMMISSIONER FOR PATENTS  
WASHINGTON, D.C. 20231

SIR:

Preliminary to any action on the merits, please amend the above-identified application  
as follows:

IN THE SPECIFICATION

Page 1, line 5, change "FIELD OF THE INVENTION" to

--BACKGROUND OF THE INVENTION

Field of the Invention--;

line 13, change "STATE OF THE ART" to

--Discussion of the Background--.

## IN THE CLAIMS

Please amend the claims as follows:

Claim 1, line 4, delete "(14)"; same line, delete "(15)";

line 5, delete "(3, 8)";

line 6, delete "(1, 6)";

line 7, delete "(1, 6)"; same line, delete "(15)";

line 10, delete "(3, 8)";

line 11, delete "(14)";

line 12, delete "(1, 6)";

line 13, delete "(2, 7)"; same line, delete "(15)".

Claim 2, line 1, change "claims 1 or 2" to --claim 1--;

line 2, delete "(3, 8)".

Claim 3, line 1, change "claims 1 or 2" to --claim 1--;

line 2, delete "(2, 7)".

Claim 4, line 1, delete "(2, 7)".

Claim 6, line 1, change "any one of the preceding claims" to --claim 1--.

Claim 7, line 1, change "any one of claims 1-6" to --claim 1--.

Claim 9, line 1, change "any one of claims 6-8" to --claim 6--.

Please add new Claims 10-20 as follows:

--10. A heat exchanger according to Claim 2, characterized by the leakage vent consisting of holes, arranged in rotational symmetry, through the plates, such that the holes register when turning every other plate 180°.

11. A heat exchanger according to Claim 2, characterized by a sensor for detecting leakage being located in one or more blocked-off spaces.

12. A heat exchanger according to Claim 3, characterized by a sensor for detecting leakage being located in one or more blocked-off spaces.

13. A heat exchanger according to Claim 4, characterized by a sensor for detecting leakage being located in one or more blocked-off spaces.

14. A heat exchanger according to Claim 5, characterized by a sensor for detecting leakage being located in one or more blocked-off spaces.

15. A heat exchanger according to Claim 2, characterized by a pipe running from one or more closed-off spaces, said pipe being connected to a sensor for detecting leakage.

16. A heat exchanger according to Claim 3, characterized by a pipe running from one or more closed-off spaces, said pipe being connected to a sensor for detecting leakage.

17. A heat exchanger according to Claim 4, characterized by a pipe running from one or more closed-off spaces, said pipe being connected to a sensor for detecting leakage.

18. A heat exchanger according to Claim 5, characterized by a pipe running from one or more closed-off spaces, said pipe being connected to a sensor for detecting leakage.

19. A heat exchanger according to Claim 6, characterized by a pipe running from one or more closed-off spaces, said pipe being connected to a sensor for detecting leakage.

20. A heat exchanger according to Claim 7, characterized by said sensor being connected to a security system.--

#### IN THE ABSTRACT OF THE DISCLOSURE

Please insert the following new Abstract:

--ABSTRACT OF THE DISCLOSURE

A heat exchanger with a leakage vent. A fully brazed heat exchanger has an arrangement preventing the two media inside the heat exchanger from mixing in case of leakage. The heat exchanger includes plates having a pattern of grooves and inlet and outlet connections. The plates are placed in a pack and brazed together so as to form separate channels for two media between alternating pairs of plates. A separation zone is created around the connection so as to block off the medium that is not to reach the respective connection. The other medium can flow on by. A leakage vent to the exterior is provided in the separation zone so as to allow detection of any leakage. --

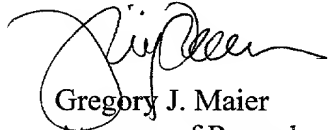
REMARKS

Favorable consideration of this application, as presently amended, is respectfully requested.

By way of the present Preliminary Amendment, Applicant has amended the application to place it in better form for examination. Accordingly, appropriate headings have been added to the specification. Unnecessary reference numerals have been removed from the claims. Multiple dependencies have been canceled, many of which have been reinstated as singly dependent claims. A new Abstract has been inserted in standard U.S. format. No new matter has been entered by way of this amendment.

In view of the above, Applicant submits that the application is now in condition for examination. Accordingly, an early and favorable action is respectfully requested.

Respectfully submitted,  
OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



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OBLON, SPIVAK, McCLELLAND, MAIER & NEUSTADT, P.C.

Applicant or Patentee: Lars PERSSON

Serial or Patent No.: PCT/SE98/00273

Atty. Dkt. No.: 10438-0001-6 PCT

Filed or Issued: 17 February 1998

For: HEAT EXCHANGER WITH LEAKAGE VENT

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN**

I hereby declare that I am

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN EP TECHNOLOGY AB

ADDRESS OF CONCERN Hanogatan 5, SE-211 24 MALMO, SWEDEN

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled HEAT EXCHANGER WITH LEAKAGE VENT

by inventor(s)

Lars PERSSON

described in

☐ the specification filed herewith

☒ application serial no. 09/380,080, filed 25 August 1999

☐ patent no. \_\_\_\_\_, issued \_\_\_\_\_

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below\* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). \*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any application any patent issuing thereon, or any patent to which this verified statement is directed.

✓ NAME OF PERSON SIGNING Lars PERSSON

✓ TITLE OF PERSON OTHER THAN OWNER Managing Director

ADDRESS OF PERSON SIGNING Kustvägen 108, SE-274 56 ABBEKÅS  
Sweden

SIGNATURE [Signature]

DATE Oct 10 - 99



## HEAT EXCHANGER WITH LEAKAGE VENT

### 5 FIELD OF THE INVENTION

The present invention relates to a heat exchanger with a leakage vent, and more particularly to a fully brazed heat exchanger having an arrangement preventing the two media inside the heat exchanger from mixing in case of leakage. The invention also allows quick detection of the leakage. A separation zone is provided at each connection to the heat exchanger. The separation zone comprises a blocked-off space with leakage vents, where any leakage can be detected.

### STATE OF THE ART

The fully brazed heat exchangers of today comprise of brazed packs of plates lacking any possibility of internal inspection. One problem existing in such heat exchangers is that a brazing at a connection may break inside the heat exchanger. An invisible leak is then created inside the heat exchanger, whereupon the media become mixed without this being detectable from outside the heat exchanger. This has meant that such heat exchangers have been used only reluctantly e.g. for the cooling of machinery where the oil lubricating the machine is cooled by heat exchange with water. Water mixing into the oil could cause catastrophic results for the machine, which could in the worst case seize up completely.

Another type of heat exchanger is the seal type heat exchanger, which is held together by screw joints, with seals between the heat exchanger plates. The above problem of internal leakage has in these heat exchangers been solved by means of the seal extending in such a manner as to create a separation zone at each connection, and to create a leakage vent in the seal at the edge of the heat exchanger, in the separation zones. This means that any leakage will be externally visible. However, the heat exchanger will also have a large number of holes at the sides, resulting in other practical problems. Furthermore, the seal type heat exchanger can only be used for lower pressures (up to 50 bar); whereas brazed heat exchangers can be used for considerably higher pressures (up to 300 bar). The heat exchanger seals will age and have to be replaced at regular intervals. Brazed heat exchangers on the other hand are practically maintenance-free and furthermore cheaper to produce than seal type heat exchangers. Thus, it would be highly desirable to be able to use fully brazed heat exchangers in more applications than has been previously possible.

The present invention solves the above problem of internal leakage in a fully brazed heat exchanger by providing a separation zone at the connections. In

case of a brazed seam breaking, a leakage occurs into the separation zone. The separation zone has a leakage vent to the exterior surroundings, enabling quick detection of the leakage. However, no mixing of media occurs due to the leakage.

## 5 SUMMARY OF THE INVENTION

The present invention thus provides a heat exchanger comprising plates having a pattern of grooves and inlet and outlet connections. The plates are placed so as to form a pack and brazed together so as to form separate channels for two media between alternating pairs of plates.

10 According to the invention, a separation zone is created around the connections, so as to block off the medium that is not to reach the connection in question, whereas the other medium can flow on by. A leakage vent to the exterior is provided in the separation zone so as to allow detection of any leakage.

The invention is defined in claim 1. Preferred embodiments of the invention  
15 are detailed in the dependent claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in further detail below, with reference to the accompanying drawings, of which:

20

Fig. 1 is a top view of a plate for a heat exchanger according to the present invention,

Fig. 2A is a sectional view along the line A-A of Fig. 1,

Fig. 2B is a sectional view along the line B-B of Fig. 1,

Fig. 3 is a top view of the plate of Fig. 1 together with another plate, the first plate being shown with broken lines to illustrate the orientation of two plates, and

Fig. 4 is a partial cross section view through three plates according to the present invention.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a plate for a heat exchanger according to the present invention. As is conventional, the plate has a groove pattern and connections. The grooves have peaks 4 and valleys 5. A cold medium has an inlet at C2 and an outlet at C1. A hot medium has an inlet at H2 and an outlet at H1. It is to be understood that the groove pattern may be varied in many different ways without deviating from the scope of the invention.

A heat exchanger is created by assembling a number of identical plates into a pack. Every other plate is turned 180° so as to create a crossing pattern and to form channels for the media between alternating pairs of plates, as is well known to those skilled in the art. Fig. 3 shows a lower plate visible through an upper plate in order to illustrate the crossing pattern. On one side of the pack there is also a bottom plate (not shown) for closing the connections on one side. The whole pack is brazed together in an oven so as to create brazing points where peaks cross each other. In a cross section, a honeycomb pattern is created. Furthermore, every other pair of plates is brazed together at the connections. This is explained in greater detail below, with reference to Fig. 4.

In a conventional heat exchanger, however, the groove pattern does not extend as shown in the drawings, but will run without interruption up to the brazing around the connections. It will be understood that if such a brazing breaks, the medium in the connection may penetrate into the wrong channel, i.e. a channel belonging to the other medium. This will cause the problem as described above.

The present inventor has realised that the problem can be solved by means of an arrangement described hereinafter. Around each connection there is a separation zone created by a separation groove. The separation groove is preferably designed approximately like a quarter circle segment. Into the separation zone only that medium is allowed entry which flows in or out through the connection. Within the separation zone there is a blocked-off space, which cannot be reached by any one of the media. This space is provided with a leakage vent. The leakage vent is arranged in such a way that the medium flowing through the connection flows around the hole via the grooves. Thus, this medium does not "see" the hole. Nor can the other medium, flowing in the surrounding channels, reach the hole, due to the separation groove. The leakage vent can only be reached by medium if the brazing around the connection, or at the separation groove, breaks.

Figs. 2A and 2B show the cross sections of two connections. Fig. 2A represents a connection that is lowered in relation to a reference plane 10, as shown at 1, whereas Fig. 2B illustrates a connection that is raised, as shown at 6. At the lowered connection 1, there is a lowered separation groove 3. At the raised connection there is a raised separation groove 8. At the lowered connection 1, there is

a raised leakage vent 2. At the raised connection there is a lowered leakage vent 7. The leakage vents come from the blocked-off space 15 (Fig. 4).

Fig. 4 shows a cross section of three plates at a raised outlet connection, as shown at 6, where a medium H1 flows out. Brazings are shown as depicted at 11. The flowing out of the medium H1 is shown by arrows. The medium H1 arrives from channels created between alternating pairs of plates. The figure shows the two top ones of one pair and the top one of the next pair. The other medium is flowing in channels between the intermediate pairs, i.e. the two lower plates shown in Fig. 4, etc. The medium C does not reach the connection as it is blocked inside its channel at the separation grooves 3, 8. A separation zone 14 is thus created between the separation grooves 3, 8 and the brazing around the connection 6 and the edge 9 of the plates. The separation zone has a blocked-off space 15 that cannot be reached by the media H1, C. The blocked-off space is open to the atmosphere through the hole 2, 7 in each plate. These holes constitute the leakage vent. The leakage vent may optionally pass also through the bottom plate (not shown), but is suitably open only in one direction.

During normal operation, the medium H thus flows inside its channels past the leakage vent via the grooves, whereas the other medium C only reaches the separation zone. At the connections to the medium C, the reverse conditions of course prevail. If a brazing should break, either at 13, that is at the connection (or at the separation grooves 3, 8), the medium, in Fig. 4 the medium H (or C, respectively), will leak into the separation zone. Depending on the orientation of the heat exchanger, which may be arbitrary, the leaking medium will be collected in the separation zone and will subsequently be vented through the outermost of the holes 2, 7 to the exterior. Typically, such breaks occur at the connection, i.e. at 13 in Fig. 4. There is then no risk of the medium H penetrating into the wrong channel, to the other medium C, as was the case with the prior art, where the brazing at the connection was the only barrier between the media. Should the brazing break at the separation grooves 3, 8, there is also no risk of mixing the media.

When a leakage occurs, a little of the medium thus penetrates to the exterior of the heat exchanger. This may be detected by visual inspection of the heat exchanger. It is, however, preferable if this detection is performed automatically. According to a preferred embodiment of the invention, a sensor is connected to at least one separation zone; preferably to all four separation zones. The sensor may be located inside the separation zone in question or be connected via piping between the separation zone and the sensor. The different pipes from the separation zones may be connected to the same sensor.

The sensor or sensors may in turn be connected to some kind of security system. The security system may e.g. cause an alarm via audible signals or warn-

ing lights. For sensitive equipment, the security system can also provide for the machine to be stopped as soon as a leakage is detected.

It will be understood that the invention depicted in the drawings and the description may be varied in several ways. The number of leakage holes 2, 7 may be higher than one in each separation zone. It is to be understood that the holes must be located in rotational symmetry, as every other plate is turned 180°. In the drawing, the holes are shown located at an angle of 45°, centred between the edges of the plates, but it is possible to locate the holes close to an edge. Arranging the holes closer to the edge may in certain cases make them more easily accessible. A person skilled in the art will furthermore understand that different types of sensors and their connections to the separation zones are possible. All such possibilities are considered to be within the scope of the invention.

The present invention thus provides a heat exchanger exhibiting several advantages compared to the previously known art. The invention allows for fully brazed heat exchangers, which are inexpensive in manufacture, may operate at higher pressures, and are practically maintenance-free, to be used within a much wider field of application, thanks to the risk of mixing the media in case of leakage and the catastrophic results involved, being eliminated. It is actually possible to continue operation in case of a minor leakage, as the risk of disaster is practically eliminated. Simultaneously, the invention provides a quick and automatic detection of leakage that may be used in security systems. The advantages of the invention are achieved at the cost only of the separation zone, which as such entails a somewhat reduced efficiency of the heat exchanger. This reduction may however be regarded as very minor, and is also present in the previously mentioned seal type heat exchangers.

Advantageous embodiments of the invention have been described in detail. As was stated above, the invention may be modified in various ways without departing from the scope thereof, as defined by the accompanying claims.

CLAIMS

1. A heat exchanger comprising plates having a pattern of grooves, and inlet and outlet connections, placed so as to form a pack and brazed together so as to  
5 form separate channels for two media between alternating pairs of plates, **characterised** by a separation zone (14), having a blocked-off space (15), formed by a barrier of valleys and peaks (3, 8) in contact with each other in alternate pairs of plates at a distance from the connections (1, 6), the brazing at the edges of the plates and the brazing at the connections (1, 6), which blocked-off space (15)  
10 cannot be reached by any one of the media except during leakage, in such a way that the medium which is not to reach and flow through the respective connection is blocked at the barrier (3, 8) between one pair of plates, whereas the other medium can flow through the separation zone (14) in adjacent channels in surrounding pairs of plates and on through the respective connection (1, 6); and by  
15 a leakage vent (2, 7) from the blocked-off space (15) to the exterior.

2. A heat exchanger according to claims 1 or 2, **characterised** by the blocked-off space being formed by a separation groove (3, 8), running at a distance from each connection and separating the connection towards the respective corner.

3. A heat exchanger according to claims 1 or 2, **characterised** by the leakage  
20 vent (2, 7) consisting of holes, arranged in rotational symmetry, through the plates, such that the holes register when turning every other plate 180°.

4. A heat exchanger according to claim 3, **characterised** by the holes (2, 7) being located at an angle of 45°, centred between the edges of the plates.

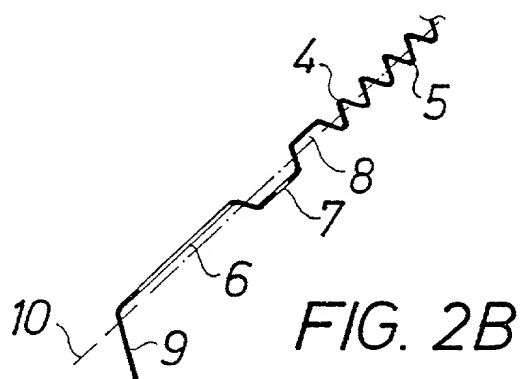
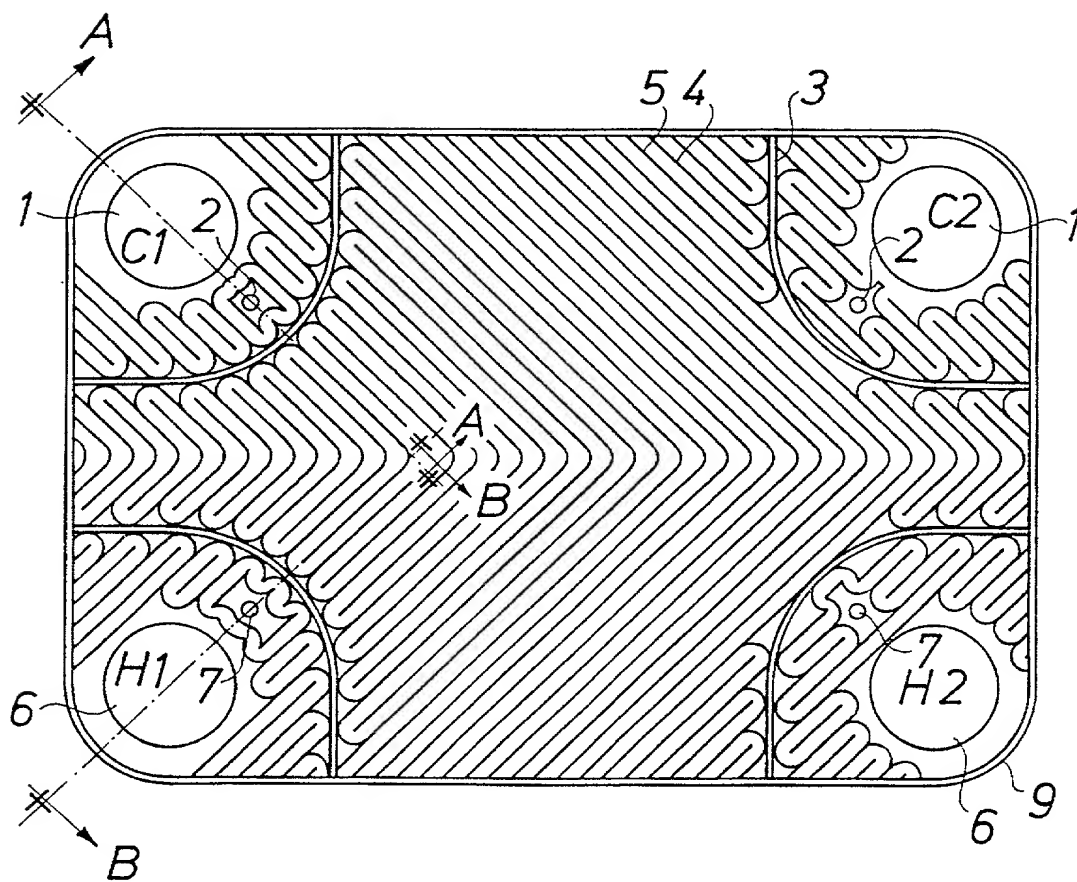
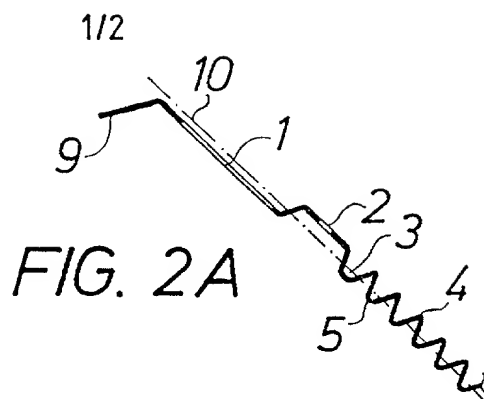
5. A heat exchanger according to claim 3, **characterised** by the hole being  
25 located close to one edge of the plates.

6. A heat exchanger according to any one of the preceding claims, **characterised** by a sensor for detecting leakage being located in one or more blocked-off spaces.

7. A heat exchanger according to any one of claims 1-6, **characterised** by a  
30 pipe running from one or more closed-off spaces, said pipe being connected to a sensor for detecting leakage.

8. A heat exchanger according to claim 7, **characterised** by several pipes being connected to a common sensor.

9. A heat exchanger according to any one of claims 6-8, **characterised** by said  
35 sensor(s) being connected to a security system.



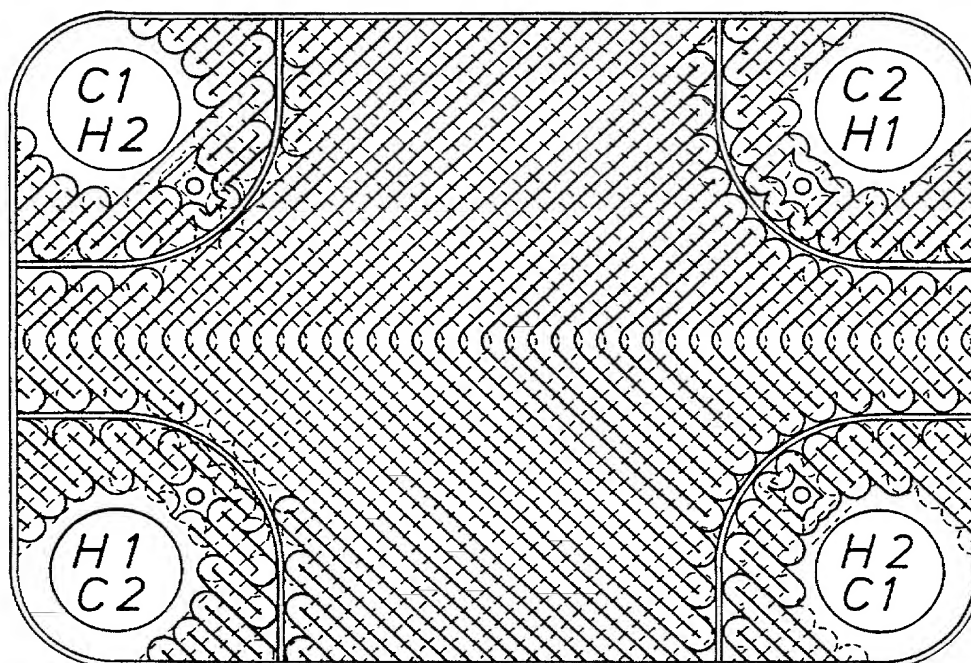


FIG. 3

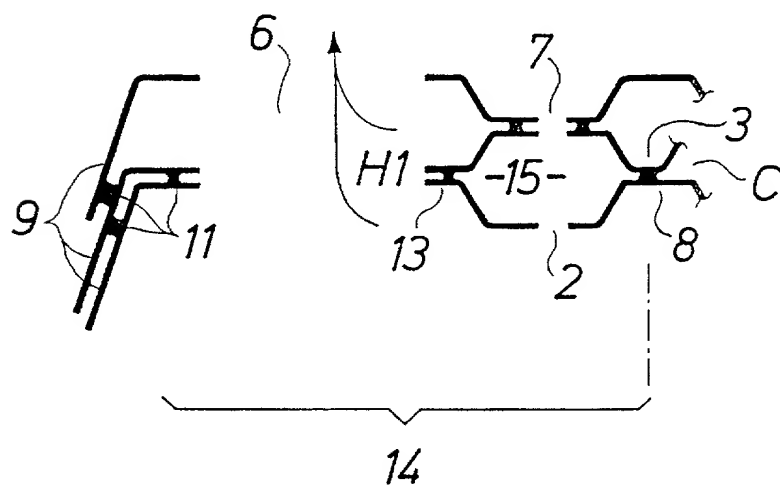


FIG. 4



# Declaration, Power Of Attorney and Petition

Page 1 of 2.

WE (I) the undersigned inventor(s), hereby declare(s) that:

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first, and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled

HEAT EXCHANGER WITH LEAKAGE VENT

the specification of which

☐ is attached hereto.

☒ was filed on August 25, 1999 as

Application Serial No. \_\_\_\_\_

and amended on \_\_\_\_\_.

☒ was filed as PCT international application

Number PCT/SE98/00273

on 17 February 1998,

and was amended under PCT Article 19

on \_\_\_\_\_ (if applicable).

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application(s)

Application No.	Country	Day/Month/Year	Priority Claimed
<u>9700657-1</u>	<u>SWEDEN</u>	<u>25 February 1997</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No

We (I) hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

_____ (Application Number)	_____ (Filing Date)
_____ (Application Number)	_____ (Filing Date)

We (I) hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Application Serial No.	Filing Date	Status (pending, patented, abandoned)
PCT/SE98/00273	17 February 1998	_____
_____	_____	_____
_____	_____	_____

And we (I) hereby appoint: Norman F. Oblon, Reg. No. 24,618; Marvin J. Spivak, Reg. No. 24,913; C. Irvin McClelland, Reg. No. 21,124; Gregory J. Maier, Reg. No. 25,599; Arthur I. Neustadt, Reg. No. 24,854; Richard D. Kelly, Reg. No. 27,757; James D. Hamilton, Reg. No. 28,421; Eckhard H. Kuesters, Reg. No. 28,870; Robert T. Pous, Reg. No. 29,099; Charles L. Gholz, Reg. No. 26,395; Vincent J. Sunderdick, Reg. No. 29,004; William E. Beaumont, Reg. No. 30,996; Robert F. Gnuse, Reg. No. 27,295; Jean-Paul Lavalleye, Reg. No. 31,451; Stephen G. Baxter, Reg. No. 32,884; Robert W. Hahl, Reg. No. 33,893; Richard L. Treanor, Reg. No. 36,379; Steven P. Weihrouch, Reg. No. 32,829; John T. Goolkasian, Reg. No. 26,142; Richard L. Chinn, Reg. No. 34,305; Steven E. Lipman, Reg. No. 30,011; Carl E. Schlier, Reg. No. 34,426; James J. Kulbaski, Reg. No. 34,648; Richard A. Neifeld, Reg. No. 35,299; J. Derek Mason, Reg. No. 35,270; Surinder Sachar, Reg. No. 34,423; Christina M. Gadiano, Reg. No. 37,628; Jeffrey B. McIntyre, Reg. No. 36,867; Paul E. Rauch, Reg. No. 38,591; William T. Enos, Reg. No. 33,128; and Michael E. McCabe, Jr., Reg. No. 37,182; our (my) attorneys, with full powers of substitution and revocation, to prosecute this application and to transact all business in the Patent Office connected therewith; and we (I) hereby request that all correspondence regarding this application be sent to the firm of OBLON, SPIVAK, McCLELLAND, MAIER & NEUSTADT, P.C., whose Post Office Address is: Fourth Floor, 1755 Jefferson Davis Highway, Arlington, Virginia 22202.

We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Lars PERSSON

NAME OF FIRST SOLE INVENTOR

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SE-274 56 ABBEKÄS, Sweden SEX

Signature of Inventor

Citizen of: SWEDEN

Post Office Address: same as above

Date